



FLIGHT SIMULATOR

B-24



COMBAT SIMULATOR



B-24: Liberators Over Ploesti

Introduction

B-24 is a simulation of the 19 missions against the Ploesti oil refineries, some of which were flown by the 460th Bombardment Group from its airfield in Spinazolla, Italy. As the major supplier of oil for the Nazi war machine, Ploesti was one of the most heavily defended targets in Europe. More bombers were downed by flak over Ploesti than over any other target in the war.

B-24 is a simulation on several different levels. As you play the game, you will be performing the tasks of pilot, copilot, navigator, engineer, and bombardier. As the crew of the lead Liberator, you will determine the flight path, speed, altitude, and bomb drop point for an entire bomber formation. As the representative of all the air forces in the game, your performance will set the effectiveness of the 460th Bombardment Group, 55th Bomb Wing, 15th Air Force, and all of the other formations, groups, wings, and air forces which attacked Ploesti.

(Ploesti was only one of the targets bombed by the 460th. As an item of gaming and historical interest, a copy of some of the information given to the crews for the actual Ploesti bombing is included in the Air Objective Folder.)

The B-24 Liberator was produced in greater numbers with more variants than any other U.S. aircraft in World War II. It was used over a longer period of time and in more theatres of operation than any other heavy bomber on either side.

The Liberator was plagued by several problems during its career. It was prone to fuel leaks. Its superchargers often failed. It was tail heavy. Bombardier and navigator were forced to operate from cramped quarters with limited visibility. It was physically tiring to fly

aged and operating at full capacity.

"A/C READY 40" means that 40 aircraft are available for this mission. "A/C IN MAINT. 0" means that no aircraft are undergoing maintenance (which would make them unavailable for the mission). "A/C lost 0" means that no aircraft were lost on the previous mission.

"TARGET CLEAR" indicates the weather is clear.

"(G) TO GO, (O) TO STAND DOWN?" means you press the **G** key to take this mission. To stand down today (not fly a mission) you would press **O**. Enter **G** when you have finished reading the screen and the next screen will be displayed.

"MISSION 1" means this is your first mission. "GROUP EFFICIENCY = 100%" shows your current efficiency.

"TARGET LOCATION X325.18 Y186.50" gives the X, Y coordinates of your target. You should be at this location (or as close to it as possible) when you drop your bombs. Mostar is shown on your Data Card map at these coordinates.

"BOMBING ALTITUDE 10000" shows the mission has been assigned a bombing altitude of 10000 feet (± 99 feet). Bombing from other than the assigned altitude will deduct from your bombing accuracy.

"ASSEMBLY A/C X150 Y150 BLK" shows that your bombing group is to form up in the block (i.e. screen) where the X coordinates range from 150.00 to 159.99 and the Y coordinates range from 150.00 to 159.99 (this is the block the home airstrip is on). " <160 MPH" indicates that your indicated airspeed (IAS) should be less than 160 miles per hour while you are forming up (but be sure to keep it above IAS 145 or you will fall out of formation).

B: This shows your degree of bank or turn. In the Introductory Mission, you may bank up to a maximum of 2. *NOTE: the more severe your bank, the easier it is to stall.*

Horizon Indicator: The narrow box between B and P. Watch the lines inside the box. When they are higher on the left, you are turning left. When they are higher on the right, you are turning right. When the line is thin along the bottom, your nose is pointed up. When the line goes nearly to the top of the box, your nose is pointed down.

P: This shows your degree of Pitch. At this time, your P is 0 which means your aircraft's nose is level. When P is positive, your nose is pointed up. When P is negative, your nose is pointed down. *NOTE: it is possible to lose altitude when P is a positive number >0 .*

There are four engines. These are represented by the four "1"s above the four boxes. You will press + to increase engine power and - to decrease it. In the event of an oil leak or windmill, you may have to feather an engine. To do this, press the key that corresponds to the engine number to be shut down (1, 2, 3, or 4). Once an engine reaches 0 power for any reason, it cannot be restarted for the rest of the mission.

Windmilling occurs when a propeller increases drag on the B-24. The remedy for this is to "feather" the engine (move the propeller to streamline so this resistance is eliminated). Feathering must occur while there is still oil left from the engine. You may make only one attempt to feather an engine.

Messages: The section of the screen which displays your target altitude when the space bar is pressed. Normally, your game speed is shown here. Game speed will range from "REAL TIME $\times 1$ " (the slowest speed, where the game is played in real time) to "REAL TIME $\times 60$ " (the fastest speed). "REAL TIME $\times 4$ " is the fastest speed while turning.

While playing the game, pressing **N** will call on the navigator to display the X and Y coordinates of the aircraft (if known) and the time that has elapsed since the beginning of the mission. It will also replace the visual display with a representation of the strategic game map. On this map, the location of your aircraft (if known) will be shown as a white plus symbol (+). *NOTE: This symbol may look like a diamond on some monitors.* The locations of airstrips and bomb targets will be shown as white rectangles. The locations of fighter rendezvous areas will be shown as black Xs.

Note: Mountain areas of Yugoslavia and Rumania are shown in black.

Pressing **E** will call on the engineer to display the amount of fuel remaining and the number of bombers in your bomber group. The game will pause while you are receiving this information and start again when you press the space bar. Other important information will be displayed here throughout the mission.

The Takeoff

Above the information display, your bomber is waiting on the runway. About halfway up the runway and to the right, the control tower is seen as a black rectangle. When you are taking off, if your IAS is not 110 or greater by the time you reach the control tower, abort the takeoff by pressing the **Q** key (shift/1).

Hit the space bar to start the game again. Press the **F** key twice to drop your flaps to 20. Now press the + key eight times to increase your engine power to 9. Press the space bar to stop

Y160 Block (screen). Come out of your bank (by moving the joystick to the right) when your HDG is 75 (approximately). Set your power at 8 and Pat 5 (you may have to alternate between a power of 8 and 9 to maintain an IAS between 155 and 160).

Note: Except when in the same block (screen) as the target, you will fall out of formation if your IAS is 145 or less.

Press the **A** key twice. This will speed the game up by a factor of 4 (to real time times 16). Except in combat (enemy fighters or flak), you may double the game speed at anytime (until it reaches maximum) by pressing the **A** key. Pressing the **Z** key will automatically jump the game to maximum speed. You may return to slowest speed by pressing the button on the joystick. Banking, flak, and certain types of problems will also slow the game.

You may have to adjust your HDG as you near the X180, Y160 Block. Check with the navigator for your X, Y position to make sure you don't miss the rendezvous area. For maximum fighter coverage, arrive at the rendezvous area as close to ET 0:25:00 as possible. If you arrive early, circle until the fighters join up.

When the message "ESCORT JOINED" appears, you will see two smaller aircraft leading your formation. Maintain a HDG of 75. Continue to climb until you reach bombing altitude (10000) and then level off. You will probably have to keep Power between 6 and 7 to maintain IAS between 155 and 160. You may press **A** to speed up the game.

Keep checking with your navigator. When you are about two-thirds up the HDG strip (Y coordinate is 186.50), set HDG to 90. *Note: When maneuvering, you may have to press the button on the joystick (to return to REAL TIME x 1) before you can get the exact heading you want. After getting the correct heading, you may speed the game up again.*

When you enter the X310, Y180 Block, you will be next to land and may run into enemy fighters. You are also adjacent to the target block.

The Bomb Run

When about halfway through the block, press the button on the joystick to set the game to real time (its slowest setting) and prepare for your bombing run. Open the bomb bay doors by pressing **O**. This turns on your bombsight. You will see numbers next to the X and Y at the right of your instrument panel. *Note: When cloud cover is present, you will not get X Y coordinates from your bombsight or navigator. If unsure of what to do and not in a flak block, circle until the clouds go away.*

When lining up for this bombing run, the Y number is the most important. If it is a negative number, you are too far north and must bank right to correct. If it is a positive number, you are too far south and must bank left to correct. When Y is 0, your HDG should be 90.

When you open your bomb bay doors, your formation will be replaced on the screen by the bomb sight symbol. The added drag from the open doors will slow you down, so be ready to add power as needed. You want to bomb with an IAS as close to 155 as possible.

When you reach the X320, Y180 Block, you will start to take flak. *Note: You do not want to enter the target block if you are out of formation. If you can't rejoin the formation for the tar-*

out.

As you approach the runway, the X on your display should show 0 (or a number very close to 0). When the Y number approaches 1, the screen will show a close up view of the runway. You have a short period of time to do your final maneuvering. You should be only a few feet above the runway at this point and ready to pitch down. It is safest to land with your engines at the lowest power setting that will avoid stalling with 40 degrees of flaps.

Remember that the ALT of the airstrip is 500. You have to lower yourself to just above this height and level off. Just after you cross the edge of the runway, pitch the nose down and let the plane land. As soon as you are down, cut the power to 1 by repeatedly pressing the **-** key.

NOTE: if you land with a VSI of less than -499 (-500 or less) you will crash.

After your landing, a score screen will appear which will tell you how many airmen and B-24s you lost on the mission, how much of the target remained undamaged, and what score you received.

You will then return to the SELECT GAME MENU.

Now that you have flown at least one INTRODUCTORY MISSION, the following sections will introduce you to the complete gaming rules, goals, and successful flying tips.

3. Goal

Your role in this game is the commander of the 460th Bomb Group(h) stationed at Spinazolla Air Base in Italy. The game begins in March, 1944. This group flew 217 missions until inactivated in September, 1945. There were 19 missions to the Ploesti area in total. If you crash or get captured on any mission, then you will be the next commander in line (of 60 aircraft the group started with, only 4 remained after the first 50 missions).

Your job is to reduce the total production of the Ploesti oil fields to as close to 0 as possible. After the 19 missions are completed, you may compare your performance with what was done historically (between 8500 and 9500 tons/day). If the production rate is greater than it was historically, you will be given an estimate of how much you would have prolonged the war. If you exceed the historical bombing performance, you will be given an estimate of by how much you would have shortened the war.

The Mostar mission should be viewed as an opportunity to train for the campaign. The Bucharest mission provides an opportunity to operate against a tough target without impacting your campaign game. These missions are flown against railroad marshalling yards.

4. Game Menu

At the start of each game, the SELECT GAME MENU will be displayed. The menu is preset for the Introductory Mission. This menu lets you select three different games and different levels of difficulty for a variety of factors: level E is easiest, level H is historic, and level H+ is hardest (showing how tough things could have been).

Note: When recalling a campaign game, you must reset A through I before you begin play.

Use the **A** key to select the times of

new save game disk. If you do not have a separate save game disk, you must make one. After your save game disk is inserted, press the space bar to continue with the game.

5. Campaign Selection Screen

When playing the game, you are given a choice of 12 targets. The campaign game will run until you complete 19 missions. The current game day number is displayed at the top right of this screen.

TARGET PRODUCTION (TONS / DAY) DAY 1	
1	ASTRO ROMANA 33333
2	ROMANO-AMERICANA 33333
3	CONCORDIA VEGA 41000
4	PHOENIX UNIREA 19000
5	DACIA-ROMANO 19000
6	PHOENIX-ORION 19000
7	COLOMBIA AQUILA 19000
8	STANDARD PETROL 19000
9	REDEVENTZA 19000
10	KEMIA 19000
11	CRUDITUL MINIER 19000
12	STEREA ROMANA 19000
TOTAL PRODUCTION 284335	
AIRCRAFT READY 40 NO. IN MAINT. 0	
CLEAR CLEAR	
SELECT TARGET, (0) TO STAND DOWN? ■	

Information for each target is displayed on that target's line. This information includes: the target number (1-12), the target name, and the current tons per day of production by the target.

The total production of all the targets is shown on the line below target 12. Your goal in the game is to get this total production number as low as possible by the end of the campaign.

The campaign begins with 40 aircraft ready to go and 0 in maintenance (MAINT.). As your aircraft are lost or damaged on missions, the number of ready aircraft will fall and the number of aircraft in maintenance will grow. You may need to pass missions by to permit aircraft to be repaired and replacement aircraft to arrive. The more aircraft that drop bombs on target, the more enemy production numbers will drop.

Weather status is shown for HOME, ROUTE, and TARGET. Each of these represents about one-third of the total play area. When N is selected for WIND, weather is always clear. When Y is selected for WIND, weather is clear, broken, or overcast.

Wind direction and velocity are given. The higher the wind velocity, the more load you will be able to get airborne. High winds also make it more difficult to hold a steady course. *Note: Wind speeds will at times be higher than is realistic. This is because temperature has been factored into wind effects for simplification.*

To select a target, press the number key(s) for that target and then press **RETURN**. To stand down (not fly a mission this game day), press the **0** key and then press **RETURN**.

Refer to the data card for illustrations of the targets.

6. Mission Information Screen

This is the screen that provides you with the "briefing" for the mission you have chosen. You may want to write down some of the information presented here so that you can refer to it later in the mission.

"MISSION N" means this is your Nth mission. "GROUP EFFICIENCY = N" shows your current efficiency. The number shown here will change after you fly missions. Successful missions increase

tion than any other heavy bomber on either side.

The Liberator was plagued by several problems during its career. It was prone to fuel leaks. Its superchargers often failed. It was tail heavy. Bombardier and navigator were forced to operate from cramped quarters with limited visibility. It was physically tiring to fly and difficult to maneuver. It had fewer guns and less armor than the B-17 and was more vulnerable to enemy fighters.

All of these difficulties are reflected in the game. Your task is to go through the 19 missions doing more damage to Floesti oil production than was done historically. To do this with your original crew and with all of the realism provided in advanced versions of the game will be a challenge.

We recommend that you work with the Mostar and Bucharest missions until you can take off, bomb the target, and land successfully. Once you are comfortable with this, we recommend that you turn to the Campaign Game.

1. Learning to Fly

The game is a dynamic model of the B-24. It is simplified in a way which points out the important aspects of this airplane while making it flyable by anyone who is not a pilot. Yet it is not simple to fly.

The aircraft will react to all changes in loading and its flight characteristics are quite real. When first learning the game, act like a test pilot and fly it around. Forget the rest of the game until you know the airplane.

Practice taking off and landing with different loads. Find out what the different stall speeds are with different loads and in different weather conditions. Try different flap settings, gear up, gear down, bomb bay doors open and closed. This is what every pilot does when he first gets a new aircraft. When you feel you know the aircraft, then go to war.

The following section will walk you through an Introductory Mission. We cannot recommend strongly enough that you complete this mission successfully at least once before moving on to the more challenging missions. Much of what is basic to the game is explained in the Introductory Mission.

Starting a Commodore Version Game

Turn on your system. Place the game disk into the disk drive. Enter **LOAD*****8 on your keyboard. When the message "READY" appears on your screen, enter **RUN** on your keyboard.

During loading, different screens will be put up including a copyright screen and a graphic representation of the B-24 bomber. One of these screens will ask you to select either the game or a game demo. To play the game, press **A**. To see the computer play a demonstration game against itself, press **B**.

NOTE: A joystick is required to play the game. The joystick must be connected to Control Port 2.

2. Introductory Mission

The menu is preset for the Introductory Missions. Press the space bar to advance to the next screen.

Mission Information

This screen provides your mission briefing.

"MOSTAR" is your target. "100% LEFT" indicates the target is undam-

aged. The X coordinates range from 150.00 to 159.99 and the Y coordinates range from 150.00 to 159.99 (this is the block the home airstrip is on). "**@<160 MPH**" indicates that your indicated airspeed (IAS) should be less than 160 miles per hour while you are forming up (but be sure to keep it above IAS 145 or you will fall out of formation).

"**ASSEMBLY ALT. FROM 2000' TO 3000'**" means your group is to assemble at an altitude between 2,000 feet and 3,000 feet.

"**JOIN ROUTE OUT ESCORT AT X180 Y160 BLK**" gives the rendezvous area for your outbound fighters. The block (screen) in this case is that for X coordinates 180.00 to 189.99 and Y coordinates 160.00 and 169.99. "**25 MIN. ET.**" means that the fighters will arrive at the rendezvous area after 25 minutes of game time have elapsed (ET. means elapsed time). The fighters will wait for you at the rendezvous point, but they have limited fuel. The longer you keep them waiting, the less time they will be able to provide you with cover.

"**LEAD A/C IS HANGAR QUEEN**" gives you the name of the B-24 you will be flying.

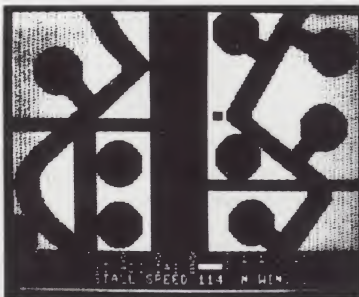
Hit the space bar. You will be asked how much fuel you want to take. Enter 1000.

You are now asked how many 500-pound bombs you want. Enter 12.

After you enter 12, the take off screen will appear. Press the space bar to stop the game (when you use the space bar to stop the game, you will be shown your assigned bombing altitude). You may use the space bar to stop the game at any time. If you should get into a situation where you don't know what to do, it is a good idea to press the space bar and stop the game until you can figure things out. You restart the game by again pressing the space bar. **NOTE:** You can also use the **N** or **E** key to halt the game.

Flight Information

Most of the information you need to play the game is provided in the display across the bottom of the screen. For a detailed explanation of each section of the display panel, refer to The Instrument Panel section of this rulebook.



For purposes of the Introductory Mission, the most important information in the display is:

ALT: Indicates altitude. At this time, your altitude is 500 feet above sea level.

VSI: Shows your rate of altitude gain or, if a negative number, loss. If XXX appears here, refer to the Recovering From a Spin section of this rulebook.

HDG: This stands for heading. A HDG of 0 means you are moving straight up, a HDG of 90 means you are moving straight right, a HDG of 180 means you are moving straight down, and a HDG of 270 means you are moving straight left.

rectangle. When you are taking off, if your IAS is not 110 or greater by the time you reach the control tower, abort the takeoff by pressing the **Q** key (shift/1).

Hit the space bar to start the game again. Press the **F** key twice to drop your flaps to 20. Now press the + key eight times to increase your engine power to 9. Press the space bar to stop the game and look at the display.

Each of your engines should show 9. F should be 20. Now hit the space bar and your stall speed should be 114.

When your airspeed gets a little above stall speed (IAS > 114), pull the stick back so that P (Pitch) is 1. As soon as you climb, the screen will change to show your plane flying above the airstrip. Push the stick forward to level out again (PO), but be careful not to overcorrect or you may crash.

Raise your landing gear by pressing the **U** key. As soon as IAS reaches 140, raise your flaps by pressing the **R** key one time. Your F should now be 10. When IAS reaches 150, press **R** again to finish raising the flaps. F should now be 0.

Pull back on the stick until P = 5. Notice that your Horizon Indicator is now a thin line. Push the stick to the left until B = 2. Press the **A** key twice to accelerate the game to four times as fast as real time. Now press the space bar.

Several other changes have occurred in your information display since before the take off. Your HDG is changed from 0 (due to the turning caused by your bank). Your VSI (Vertical Speed Indicator) shows a positive number (P = 5 is causing you to climb fairly rapidly). Your IAS (Indicated Air Speed) is greater than 160.

Remember to watch your IAS. When you reach 2000 feet, you want it to be between 150 and 160 so your group can form up. While circling, you may have some difficulty in keeping your plane within the X150, Y150 Block (screen). If you fly off the screen to the right or the left, you may crash into hills which have an altitude of 2000.

You may fly off the top and bottom of the screen without crashing, but REMEMBER that your bomber group will only form in the proper block (X150-159.99, Y150-159.99), at the proper ALT (2000 to 3000), and at the proper speed (IAS less than 160).

Note: In order to conserve fuel and avoid enemy fighters, you will want to fly in a tight formation at an IAS between 155 and 160.

Press the space bar to continue the game. After you reach ALT 2000, reduce power by pressing the - key twice. Your engine power should be 7.

If your IAS should drop to 150 while you are climbing, increase power until it reaches 160 and then drop power back. You will receive messages telling you when other bombers are joining up. Sometimes the "BOMBER ABORTED" message will appear in your message window. Each time this occurs, you will have one less bomber for this mission.

Keep climbing until ALT 2900 and then level off (P = 0). Cut power (by pressing the - key) to keep your IAS below 160 (but above 150). After leveling off, you will probably have to alternate between a power of 6 and 7 to keep in the proper IAS range.

When the "BOMBERS JOINED UP" message appears, the single B-24 on your screen will be replaced by three smaller planes in formation. Head for the fighter rendezvous in the X180,

added drag from the open doors will slow you down, so be ready to add power as needed. You want to bomb with an IAS as close to 155 as possible.

When you reach the X320, Y180 Block, you will start to take flak. **NOTE:** You do not want to enter the target block if you are out of formation. If you can't rejoin the formation for the target run, press **F2** (shift/**F1**) to abort, turn around, and go home.

Just before both X and Y are 0 (or very close to it), you are over the target. Immediately press **S** to drop your bombs. The message "BOMBS AWAY" will appear. *Note: In case your instruments should fail, your target is the railroad yard. In case of instrument failure, refer to the Data Card for a picture of the target and drop your bombs when you are over target.*

Immediately following the bombing, press **C** to close the bomb bay doors and reduce drag. Do a left bank of 2 until your HDG is 0. **NOTE:** Be careful not to exceed IAS 165 or you will lose planes from your formation. When you leave the target block, you enter a mountain block. Stay above ALT 8000 or you will crash.

You should now be in the X320, Y190 Block. Set a course back to the airstrip. Be sure you do not cross the target block again or you will again receive enemy flak.

NOTE: It is possible that your aircraft will be damaged by enemy fighters or flak. If it is too heavily damaged, it will not be able to make it back to the airport at Spinazolla. There are closer airports, at Vis and Foggia, at which an emergency landing may be made. If you think you can't make it back, refer to the ALTERNATE LANDING STRIPS section of these rules. The most common reasons for making these landings are fuel leaks or the loss of more than one engine (you can also bail out if you are over land and more than 500 feet above it by pressing **F8** (shift/**F7**)).

You want to reach the coast of Italy at the X190, Y130 block. A HDG of 245 is about right. You may need to make adjustments as you approach the coast. Once over water, begin descending (P = -1) to get down to an ALT of 2200. When you reach the Y130 strip, take a HDG of 270. **NOTE:** You may again hit A to speed the game, but be careful. Don't let your ALT drop below 2000.

The Landing

When you reach the middle of the X150, Y130 Block, your HDG should be 0. This will require some maneuvering. Drop the landing gear (press the **D** key), set the game to its slowest speed, and descend to ALT 600. When you are within 15 miles of the landing strip, you may use the X Y indicators on the right of your display panel to guide yourself in. (For landing, the X number is the most important. When it is 0 your HDG should be 0.)

NOTE: It may be that your instruments were damaged by flak or fighters. In this case, use your game map to navigate. Each screen corresponds to a 10 mile by 10 mile square on the map. Count squares and look for landmarks. When you get to two squares below the landing strip, line up with a HDG of 0 about one B-24 wingspan west of the north-south road.

As you level out, your speed will decrease. When you see the runway, your flaps should be lowered to about 40 and your IAS should be between 115 and 122. Descend to just a few feet (ALT 510 - 520) above the runway and level

difficulty for a variety of factors: level E is easiest, level H is historic, and level H+ is hardest (showing how tough things could have been).

Note: When recalling a campaign game, you must reset A through I before you begin play.

Use the **A** key to select the types of games: Mostar, a single mission to the easiest target; Campaign, 19 missions to the petroleum plants in and around Ploesti; and Bucharest, a single mission to a difficult target.

Use the **B** key to select the level of engine performance. On level E, engines will neither overheat nor fail for mechanical reasons. On level H, engines can overheat and have a chance of failing for mechanical reasons. On level H+, engines can overheat and have a greater chance of failure.

Use the **C** key to select the reliability of your fighter escorts. At level E, the fighters are always at the rendezvous square on time. At level H, there is a chance they will be late. At level H+, there is a greater chance they will be late.

Use the **D** key to select the probability your group will be intercepted by enemy fighters. Level E sets this probability at half of the historical level. Level H sets this probability at the historical level. Level H+ sets this probability at greater than the historical level.

Use the **E** key to set flak accuracy. Level E provides for inaccurate flak. Level H provides for normal flak accuracy. Level H+ provides for very accurate flak.

Use the **F** key to set landing run out (braking ability of aircraft). Level E sets this at short. Level H sets this at normal. Level H+ sets this at long. The longer the run out, the greater the chance you will run off the end of the runway and crash when attempting to land.

Use the **G** key to set the difficulty for rejoining the mission group once you have lost it. Level E provides for a quick rejoin once target altitude is reached. Level H provides for a normal rejoin at the target altitude. Level H+ requires twice the normal distance to catch up and rejoin. You will drop out of formation when your IAS drops to or below 145. (To rejoin, you must be at target altitude and flying at greater than formation speed. The more your IAS exceeds formation speed, the sooner you will rejoin.) If you lose the formation prior to bombing it is best to abort the mission (press **F2** (shift/**F1**)) and go home.

Use the **H** key to set bombing accuracy. Level E provides increased bombing accuracy. Level H provides normal bombing accuracy. Level H+ makes accurate bombing difficult.

Wind effects are either there (**Y**) or not (**N**). When no wind is selected, the weather is always clear and there is no wind. When wind is selected, normal weather conditions are in effect. High wind will cause the airplane to drift, but also permits a takeoff with a heavier bomb load. Overcast (undercast from the bomber's viewpoint) skies make bombing and navigation difficult, but provide cover from enemy fighters and flak.

Press the space bar to advance to the next screen. You will be asked if this is your first mission. If you want to continue an existing game, answer **N**. To start a new game, answer **Y** and, if you chose the campaign game, you will be given an opportunity to format a

new game. You may want to write down some of the information presented here so that you can refer to it later in the mission.

"MISSION N" means this is your Nth mission. "GROUP EFFICIENCY = N" shows your current efficiency. The number shown here will change after you fly missions. Successful missions increase efficiency; unsuccessful missions decrease it.

"TARGET LOCATION X Y" gives the X, Y coordinates of your target. You should be as close as possible to this location when you drop your bombs. The target is shown on your map at these coordinates.

"BOMBING ALTITUDE = N" shows the mission has been assigned a bombing altitude of N feet. Bombing from other than the assigned altitude ($\pm 99'$) will deduct from your bombing accuracy.

"ASSEMBLE A/C X150 Y150 BLK" shows that your bombing group is to form up in the block (i.e. screen) where the X coordinates range from 150.00 to 159.99 and the Y coordinates range from 150.00 to 159.99. " $@ < 160$ MPH" indicates that your indicated airspeed (IAS) should be less than 160 miles per hour while you are forming up (but be sure to keep it above IAS 145).

"ASSEMBLY ALT. FROM 2000' TO 3000'" means your group is to assemble at an altitude between 2,000 feet and 3,000 feet.

"JOIN ROUTE OUT ESCORT AT X180 Y160 BLK" gives the rendezvous area for your outbound fighters. The block (screen) in this case is that for X coordinates 180.00 to 189.99 and Y coordinates 160.00 and 169.99. "25 MIN. ET." means that the fighters are scheduled to arrive at the rendezvous area after 25 minutes of game time have elapsed (ET. means elapsed time). The fighters will wait for you at the rendezvous point, but they have limited fuel. The longer you keep them waiting, the less time they will be able to provide you with cover.

"JOIN TARGET ESCORT AT X650 Y180 BLK" gives the rendezvous block (screen) for your target fighters. "3:10 ET." means the fighters are due to arrive at the rendezvous area after 3 hours and 10 minutes of game time have elapsed. **NOTE:** There are no TARGET fighters for the Mostar mission.

"JOIN ROUTE BACK ESCORT AT X650 Y140 BLK" gives the rendezvous block (screen) for your inbound fighters. "4:05 ET." means the fighters are due to arrive at the rendezvous area after 4 hours and 5 minutes of game time have elapsed. **Note:** There are no ROUTE BACK fighters for the Mostar mission.

"LEAD A/C IS N" gives you the name of the B-24 you will be flying. This name will change following each mission in which your lead aircraft crashes.

Hit the space bar. You will be asked how much fuel you want to take. For the Ploesti mission, 2400 gallons is probably a minimum. For Bucharest, 2600 is probably a minimum. Mostar can be done with 1000 gallons. How much fuel is needed depends on the distance to your target, your bombing altitude, the number of bombs you take, weather conditions, and your flying skill. **NOTE:** You can take off with a heavier load when there is a strong wind.

You are now asked how many 500-pound bombs you want. The more bombs you take, the more difficult it will be to take off and the more fuel you will burn in reaching the target.

Choosing the correct amount of fuel and number of bombs for a mission is an important and difficult decision. The following information is intended to help you choose the proper load. All of the following information assumes there is no wind.

The higher the power setting at which you fly, the more fuel you burn. You will burn the following number of gallons per hour of flight:

P9 388.8	P8 345.6	P7 302.4
P6 259.2	P5 216	P4 172.8
P3 129.6	P2 86.4	P1 43.2

One gallon of fuel weighs about 6 pounds. A full load of fuel (2814 gallons) weighs 16,884 pounds. A full load of bombs (12 at 500 pounds each) weighs 6,000 pounds. A full load of fuel and bombs will weigh 22,884 pounds.

With a maximum load, your stall speed on take off is IAS 140 with 0 flaps, IAS 135 with 10 flaps, and IAS 125 with 20 flaps or greater. With no load, your stall speed with 20 flaps is IAS 95.

With each gallon of fuel you burn, you reduce your load by 6 pounds. With each bomb you drop, you reduce your load by 500 pounds. Your load weight is therefore constantly changing. For every 84 gallons of fuel you have remaining when you land, you could have taken one more bomb on the mission (in exchange for 84 less gallons of fuel).

With a full load of bombs and fuel, your maximum continuous rate of climb is: at sea level, 594 feet per minute; at ALT 5000, 494 feet per minute; and at 10000 feet, 400 feet per minute. At sea level with 1000 gallons of fuel and no bombs, your maximum continuous climb rate is 855 feet per minute.

To reach bombing altitudes with a full load it takes a minimum of: 28 minutes to reach 10000 feet, 59 minutes to reach 15,000 feet, 1 hour and 50 minutes to reach 20,000 feet, and 2 hours and 40 minutes to reach 24,000 feet.

All of the above assumes an average IAS of 155.

At sea level with no bombs and 1000 gallons of fuel, your maximum cruising speed is IAS 201. With a full load, your maximum cruising speed at sea level is IAS 188. With a full load at 20,000 feet, your maximum cruising IAS is 163.

Flying with a full load and an IAS of 157.5: at sea level, you burn 302.4 gallons of fuel per hour and require a power setting of 7; at 10,000 feet, you burn 336.96 gallons of fuel per hour with a power setting of 7.8; and at 20,000 feet, you burn 367.2 gallons of fuel per hour at a power setting of 8.5.

Flying with 1000 gallons of fuel, 12 bombs, and an IAS of 157.5: at sea level, you burn 250.56 gallons of fuel per hour with a power setting of 5.8; at 10000 feet, you burn 293.76 gallons of fuel per hour at a power setting of 6.8; and at 20,000 feet, you burn 336.96 gallons of fuel per hour with a power setting of 7.8.

★ ★ ★ ★ ★

After you enter the bomb number, the take off screen will appear. Refer to the introductory game for information on takeoffs, bomb runs, and landings. If you have chosen weather, you may have to compensate for drift.

7. Mostar and Bucharest

The Mostar and Bucharest missions are not part of the campaign game. They are provided to give you an opportunity to sharpen your gaming skills

percent times 90 percent (.80 x .90) or 72 percent.

Your Efficiency Rating reflects the skill and experience of your group. For every plane which drops bombs on target, your efficiency rating increases by .25 percent (an additional 4 percent is awarded if you totally destroy the target). For every new replacement plane that joins your group, your efficiency drops by 1 percent. When the lead Liberator is lost (your plane), efficiency drops by 9 percent (2 percent if the crew survives).

Your Efficiency Rating will not drop below 50 percent. As long as it is below 100 percent, it will increase by one percent per day for every day you stand down.

10. Damage and Mechanical Failure

While on a mission, your aircraft may be damaged by flak, enemy fighters, mechanical failure, or engine overheating. The following types of problems may develop:

OIL LEAK: The indicated engine will begin to lose power. The engine must be feathered before all oil is lost or it cannot be feathered at all. When engine power reaches 0, it will begin to wind-mill and it cannot be feathered.

SUPERCHARGER: When a supercharger is lost to either enemy action or mechanical failure, that engine's power will be reduced by 3.

ENGINE LOSS: Engines can be lost for a variety of reasons including mechanical failure. If an engine quits because of a mechanical failure, it can be feathered. If it quits because of an oil loss, it cannot be feathered.

FUEL LEAK: Fuel is being lost at a constant rate. The more fuel leak messages you receive, the greater the rate of loss. If fuel leaks occur while far from a landing strip, it is unlikely you will be able to make it back with your aircraft. You will continue to lose fuel until you land or crash.

NOSE AND RDF (RADIO DIRECTION FINDER) HITS: These cause a loss of navigational instruments making the bombsight, navigator, and landing guide less useful or useless.

COCKPIT HITS: These cause the IAS and VIS indicators to fail.

FLAP HIT: Damaged flaps cannot be used. This makes landing much more difficult.

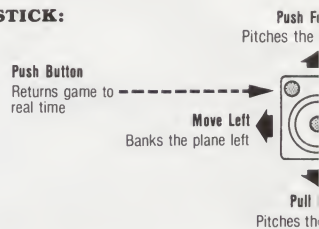
AUX HYDRAULIC OUT: This won't matter unless #3 engine is also lost. In this case, neither the landing gear nor the flaps can be lowered. The best thing to do in this case is to bail out over Italy. You have about a 50/50 chance of crash landing the plane, but even then the plane is wrecked.

NOTE: When certain problems occur, the game is set to automatically go to real time (x1) and make a warning sound until the problem is corrected. In instances where the problem cannot be corrected (flying just a little faster

12. Controls

The following controls are used in B-24:

JOYSTICK:



Commodore 64 KEYBOARD:

- | | | | | | | | | |
|----------|-------|---|---|---|---|---|---|-----------|
| ← | 1 | 2 | 3 | 4 | 5 | 6 | 7 | → |
| CTRL | Q | W | E | R | T | Y | U | |
| RUN LOCK | A | S | D | F | G | H | J | |
| C | SHIFT | Z | X | C | V | B | N | SPACE BAR |
- (+) Increases engine power up to a maximum of 9
 - (-) Decreases engine power down to a minimum of 1
 - (F) Lowers flaps down to a minimum of 40
 - (R) Raises flaps up to a maximum of 0
 - (1) Feathers engine #1
 - (2) Feathers engine #2
 - (3) Feathers engine #3
 - (4) Feathers engine #4 (Feathering will streamline to reduce drag. Engines that are losing oil or have lost power should be feathered. Once an engine has lost oil, it cannot be feathered.)
 - (D) Lowers landing gear
 - (U) Raises landing gear
 - (A) Accelerates time by increments of 2 to speed up the game. Maximum increase is times 60.
 - (Q) Toggle warning messages off and on. Can be used to eliminate the auto-reduction to slowest time when a warning is given.

13. Aerial Combat

Enemy fighters will be a constant threat to you when you are over or near Yugoslavia and Rumania. You have several methods of dealing with enemy fighters. The first of these is to fly in a tight formation. A tight formation permits the maximum use of the bomber formation's machine guns. Historically, enemy fighters would steer away from planes flying in tight formations in favor of pouncing on those flying in a sloppy formation.

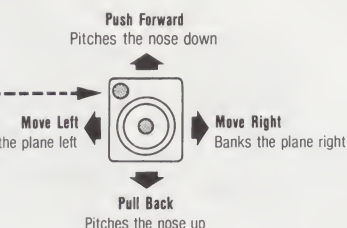
In game terms, flying in tight formation is represented by maintaining an IAS between 155 and 160. Occasionally you will see the message "BOGEYS PASS" appear on your screen. This means that an enemy fighter group has flown by, looked you over, and decided to find easier prey.

The second protection against enemy fighters is provided by friendly fighter cover. The B-24s could fly much further than the fighters which protected them. When flying on the longer missions, you will have to rendezvous with three separate fighter groups. It will require very efficient flying on your part to avoid causing gaps in your fighter cover. Fighters can stay in the air for a limited amount of time. If you are late to a rendezvous or perform unnecessary maneuvers which waste fuel, you will be cutting down on your fighter protection.

Aerial combat itself burns fuel and the more enemy groups your fighters combat, the shorter the time they will stay with you.

The third protection against enemy fighters is to fly at less than ALT 5000. This option is generally not available on the trip to target, but it can be used on the way home. This option is particularly attractive to the formation which has lost fighter protection or the plane which has lost touch with the formation.

used in B-24:



BOARD:



lowers landing gear
raises landing gear
accelerates time by
increments of 2
speed up the
game. Maximum
increase is times 60.
toggle warning
messages off and
on. Can be used to
eliminate the auto-
duction to slowest
time when a warning
is given.

- (12) Will abort a take off or mission. When a mission is aborted, the rest of the group will bomb without you. Such bombing is inaccurate and some planes are lost to combat.
- (O) Opens bomb bay doors to permit bombing and turns on bombsight
- (S) Drops bombs
- (C) Closes bomb bay doors

- (18) Bail out (if over land and at least 500 feet above it)
- (SPACE) Pauses game when hit. Restarts game when hit again.
- (N) Calls for coordinate and time information from navigator and shows game map
- (E) Calls for fuel and formation information from engineer
- (Z) Accelerates game to fastest speed (X 60) immediately

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Mountains — 8000.

Cities — the same altitude as the surrounding terrain. Note that cities are identified as having either no flak, light flak, or heavy flak. Ploesti, Campina, and Bucharest are the only heavy flak cities in the game. (See Data Card for this identification).

When on a mission, you should avoid entering the square of any city with flak unless the bombing target is also in that square. All cities east of the Adriatic are enemy controlled.

You may call up a smaller version of the map on your game screen by pressing the **N** key while playing the game.

15. The Instrument Panel

The instrument panel is shown as a display below the map screen. Information provided by this screen is important to the successful completion of a bombing mission. Except in cases of instrument failure, this information is continually updated during play.



The information provided by this display is as follows:

ALT: This indicates altitude (in feet above sea level). In the event of a loss of your Vertical Speed Indicator, you may calculate vertical speed by switching to real time and comparing your change in altitude on a minute-by-minute basis.

VSI: means vertical speed indicator (the amount of altitude lost or gained per minute). When the VSI is a negative number, you are losing altitude. The smaller the negative number (keeping in mind that -100 is smaller than -50),

much power is supplied to each engine (0 through 9). In the event of an oil leak or windmill, you may have to feather an engine. To do this, press the key that corresponds to the engine number to be shut down (The engines are numbered 1 through 4 with 1 on the left and 4 on the right) and press **Y** when asked if you want to feather the engine (You get only one chance to feather an engine each mission).

The boxes below the engine numbers show engine temperature. When the engine is hot, an **H** will appear in the box and the box will be red on color monitors. When engine temperature is normal, no letter will appear in the box and the box will be green on color monitors. Running engines for an extended period of time in the hot range will cause them to burn out. Engines will normally start to burn out when run at power level 9 for more than 20 minutes (game time). To cool engines, run them at power 8 or less.

When an engine has been feathered, the engine box will be bisected by a horizontal line. When an engine is windmilling, the engine box will be bisected by both a horizontal line and a vertical line.



Windmilling occurs when a propeller is not streamlined to the air flow and increases drag on the B-24. The remedy to this is to "feather" the engine (move the propeller to streamline so this resistance is eliminated). Feathering must occur while there is still oil pressure left from the engine.

X Y: Information is provided here for bombings and landings. When the bomb bay doors are open and you are within 10 miles of your assigned target, numbers will appear here. Maneuver your B-24 so that both the **X** and **Y** numbers are 0 (or as close to 0 as possible). Just before this point, it is time to drop your bombs. **NOTE:** While the bombsight is on, the bombardier is actually steering the B-24. When your landing gear is down and you are within 15 miles of your airstrip, numbers will again appear here. Pilot your B-24 to bring **X** to 0 and then set a course that brings **Y** continually closer to 1 until a zoom-in of the runway appears and you can land.

F: These are your flaps. When your flaps are lowered, your lift is increased and your stall speed and air speed decreased. Flaps are lowered for take offs and landings and raised for flight. **NOTE:** Flaps increase drag.

G: This is your landing gear. When the landing gear is down, the box next to **G** is filled (green on color monitors). When the landing gear is up, the box next to **G** is half filled (the filled half is red on color monitors).

Messages: The bottom of the display is devoted to your message display. When the space bar is pressed, the game will stop and this section of the screen will show your assigned bombing altitude. Normally, your game speed is shown here. Game speed will range from "REAL TIME x 1" (the slowest speed, where the game is played in real time) to "REAL TIME x 60" (the fastest speed). The fastest speed while banking is "REAL TIME x 4."

While playing the game, pressing **N** will call on the navigator to display the **X** and **Y** coordinates of the aircraft (if known) and the time that has elapsed

group in this situation will be limited and planes will be lost and damaged.

Missions may only be aborted prior to bombing.

Typically, missions should be aborted if you are unable to keep up with your formation.

Forming the Bomber Group

As a concession to playability, we have condensed the time required to form up the bomber group. Historically, this process would take a minimum of 20 minutes of real time and could take more than an hour.

Messages

When you fly at less than 5 mph above stall speed, you will get a stall warning. When you fly below IAS 150, you will be warned you are about to fall out of formation.

Bombing

Because there is a slight delay between the time the **S** key is pressed and when bombs actually drop, it is necessary to press the key a little early for the best bombing results.

17. Designer's Notes

My main motivation in designing this game is to give a three-dimensional experience to a player that reading a book on the subject cannot possibly emulate. Both Ted Newby and I would like to dedicate this simulation to the many thousands of bomber crews that experienced this first hand, both survivors and those who did not survive.

Both Ted and I feel qualified to convey this experience to those of you who would like to know what it was like. Ted was a B-24 bombardier in the 460th Bomb Group. He was shot down on his 50th mission and is the author of *Target Ploesti: View From A Bombsight*. I was a flight engineer on a B-29 with 12 missions over Korea and have been a pilot for over 40 years.

This flight simulator is a different approach than has been done in other computer flight simulators. It is impossible to get the real feel and seat-of-the-pants feedback from a computer. This simulator is designed to not be a hand-eye coordination type of game. The thrust of the design has been to emphasize the real problems that a bomber pilot must concentrate on and minimize the importance of things that a computer cannot do well (and that do not add to the point of the simulation). This does make some aspects of the flight simulator appear unrealistic, but in fact, the simulator is very realistic.

We have assumed that you as Pilot and Group Commander have long since mastered the coordination of basic flight — including the manipulations of the stick and rudder. So we have abstracted this aspect of flying, and concentrated on more important aspects of flight.

The B-24 in this simulator is very real. It is a dynamic model of the flight characteristics of this aircraft. The air speed is Indicated Air Speed and not speed over the ground. The stall speed is affected by weight and flap setting and will change as the dynamics of the aircraft change (this also includes increased load of G forces in turns). The air speed versus power setting is affected by drag of flaps, open bomb bay doors, landing gear, windmilling engines, pitch of the nose, and rate of turn.

The Mostar and Bucharest missions are not part of the campaign game. They are provided to give you an opportunity to sharpen your gaming skills before going into the campaign game. Refer to the Data Card for illustrations of Mostar and Bucharest.

Because these are independent missions, they are handled slightly differently from the campaign game. When one of these missions is selected, a screen is shown which shows the weather at HOME, ROUTE, and TARGET (TARGET only for Mostar).

There are always a full complement of 40 aircraft for these missions. The only choice the gamer has to make is whether to fly the mission (G) or stand down (O).

The MISSION INFORMATION SCREEN is the same as that for the Campaign Game except that there are no TARGET or ROUTE BACK fighter rendezvous for the Mostar mission. The ROUTE OUT fighters are able to provide protection during the entire Mostar mission.

8. Scoring

There are six levels of score (0 - 5) reflecting 6 different levels of difficulty. The higher the level, the more difficult the game. The introductory mission is Level 0. The historical campaign missions are Level 3.

Points are awarded for: taking off and landing successfully; the number of bombs taken on a mission; the number of aircraft that bomb the target; and the damage done to the target. Points are subtracted for airmen and aircraft lost.

The base score is adjusted by the level of difficulty. The higher the level of difficulty, the higher the base score is adjusted. The adjusted score is multiplied by your efficiency rating to arrive at your final score.

On a historical mission (Level 3) with an efficiency of around 100, a good score is around 600.

9. Mission Efficiency

Unlike the Mostar and Bucharest missions, performance on a single mission in the Campaign Game can have a lasting effect. This effect is the result of your group's Efficiency Rating.

When you bomb a target, how much damage you do to that target is determined by a number of factors. These are the altitude at which you bomb, your IAS when you bomb, how close you are to the correct drop point when you bomb, and how many bombs are dropped on the target (this last is dependent on both how many bombs you take on a mission and how many planes reach the target). All of this is used to determine a preliminary bombing number.

The preliminary bombing number is then multiplied by your Efficiency Rating for the final determination of how much damage was actually done to the target. For example: If your preliminary bombing number showed 80% of the target destroyed and your Efficiency Rating is 120%, the actual amount of the target destroyed on that mission would be 80 percent times 120 percent (80×1.20) or 96 percent. If your Efficiency Rating were 90%, the actual amount of destruction would be 80

percent. *real time (x1) and make a warning sound until the problem is corrected. In instances where the problem can't be corrected (flying just a little faster than stall speed as an example) you may want to toggle this feature off to end these messages and permit you to speed the game beyond real time. This feature may be toggled off and on by pressing the 9 key.*

11. Alternate Landing Strips

Vis Landing

The Vis airstrip is located in the X300, Y200 Block. It is a short airstrip intended for use by fighters. At the end of the airstrip is a 500-foot drop into the Adriatic Sea. When landing at Vis, have flaps set at 40 and use the slowest possible IAS. Pitch down the instant you cross the end of the runway and power down immediately.

The altitude of the airstrip is 500. Approach it from the south (X300, Y190 Block). Set HDG to 0 when X is about 305. You may drop your landing gear (D) when you are about one-third of the way up the screen in the X300, Y190 Block. Your altitude should be between 500 and 600 when you enter the X300, Y200 Block. You may have to spiral down to reach this altitude.

Use the X Y indicators at the right of the display to guide yourself in for the landing. X should be close to 0 as you approach. When Y approaches 1, you will see a close-up screen of the runway. When this occurs, do the final maneuvering for the landing. Your ALT should be between 520 and 500 at this point. *NOTE: the Vis screen (block) is unusual in that it has two separate altitudes. The island is at ALT 500 and the ocean is at ALT 0. It will probably be suicidal to find out exactly where the altitude line is drawn. Be sure you are above ALT 500 when landing at Vis.*

When playing a campaign game, there will be a one-day delay in returning your aircraft to the home air base following a Vis landing.

Foggia Landing

The Foggia airstrip is located in the X180, Y180 Block. A low-level approach is possible for this strip. If you are returning from a mission and find yourself unable to climb over the 2000 ALT hills which surround Spinazzola, you can still land at Foggia if you can get your ALT to a little above 500.

In making the low-level approach, fly west along the Y170 strip. When you reach the X180, Y170 block, assume a 0 degree heading at about X185.5 and lower your landing gear. Use the X Y numbers at the right of your display to guide yourself in as you would for any other landing.

The Foggia airstrip has an ALT of 500. In the event your navigational instruments aren't working, you can line up about one B-24 wingspan west of the north-south road and use it for a guide in approaching the airstrip.

When playing a campaign game, there will be a one-day delay in returning a plane to service which has landed at Foggia.

...ticularly attractive to the formation which has lost fighter protection or the plane which has lost touch with the formation.

It is possible to fly back at an altitude of just over 2000 feet. When returning from Campina, Ploesti, or Bucharest, this does require flying over one flank city. Low flying has the added advantage of saving fuel. Study the map for low altitude routes home.

Even if you do everything right, you can still be attacked by enemy fighters that fight past your fighter protection or refuse to be frightened off by your tight formation. When fighters attack, you will hear the sound of machine gun fire. Enemy fighters move to the left to attack your group. Friendly fighters move to the right to defend your group.

When enemy fighters are adjacent to your bombers and you hear a machine gun sound, at least one plane in your formation has taken some damage. Unless your plane is damaged, you will only know of this damage by seeing a smaller number of planes in your formation or by seeing more aircraft in maintenance after a mission.

14. Using the Map

A map of the bombing missions operations area has been provided with the game. An understanding of the map is necessary for success in the game. The map is an aid in plotting the most efficient course to target, low flight home (primarily for damaged aircraft), and navigation in the event of heavy overcast or instrument failure.

The map is divided into 10-mile squares. Each of these squares corresponds to a strategic screen. These screens, or blocks, are referenced in the mission briefing. Each block is referred to by its lowest numbered X and Y coordinates. **EXAMPLE:** The X160, Y180 block refers to the map square/game screen where the X coordinates run from 160.00 to 169.99 and the Y coordinates run from 180.00 to 189.99.

On the map, X coordinates run from west to east and are numbered from 100 to 799.99. The Y coordinates run from south to north and are numbered from 110 to 209.99. To find Target 1, for example, find where the X coordinate 724.92 intersects with the Y coordinate 162.94. Refer to the Strategic Map on your Data Card for examples.

A close-up map of the bomb targets is located on the reverse of the map card. These closeups show the relation of these targets to the other terrain in their screen. In the event of a bomb-sight failure, you may have to drop your bombs based on visual sightings. Your targets are either railroad marshalling yards or buildings. Refer to the illustrations of your target on your Data Card.

The map also identifies different terrain types, each with its own altitude. When crossing terrain, if the altitude of your B-24 is not greater than the terrain altitude, you will crash. To bail out, you must be a minimum of 500 feet above the terrain in the square.

Terrain altitudes (expressed as feet above sea level) are as follows:

Normal land — 500. All of your airfields are located at altitude 500.

Water — 0.

(the amount of altitude lost or gained per minute). When the VSI is a negative number, you are losing altitude. The smaller the negative number (keeping in mind that -100 is smaller than -50), the more rapid the loss. A positive number (other than 0) shows you are gaining altitude. The larger the number, the more rapid the gain. The further VSI is from 0, the greater your rate of altitude change.

HDG: This stands for heading. You may think of heading as a giant clock dial on the screen which is marked off in degrees (from 0 to 359). Instead of minutes and hours. Your B-24 is the clock hand and whichever degree it is pointed to is the number that appears beside HDG. A HDG of 0 means you are pointing straight up. A HDG of 90 means you are pointed straight to the right, a HDG of 180 means that you are pointed straight down, and a HDG of 270 means that you are pointed straight to the left. You will get more accurate information on your direction (course heading) from the HDG number than from the facing of the B-24s on the screen. *NOTE: The effects of wind can move your aircraft in a different direction than the one indicated by HDG. The stronger the wind, the greater the effect on your course.*

IAS: This shows your indicated air speed. When flying, it is necessary to keep your indicated air speed higher than your stall speed. It is important to remember that air speed is different from ground speed. Air speed measures the speed at which you are passing through the air. When diving, climbing, or in times of high winds, there may be significant differences between the speed at which you are moving through the air and the speed at which you are moving over the ground. You can fall out of formation if you fly with an IAS of 145 or less. After dropping our bombs, you can lose planes from your formation if you fly with an IAS of 165 or more.

B: This shows your degree of bank or turn. Except in the Introductory Mission, you may bank up to a maximum of 6. A B of 1 is a 10-degree bank. A B of 6 is a 60-degree bank. *NOTE: The more severe your bank, the easier it is to stall.* When you are banking, "steps" (the Horizon Indicator) will appear in the space between B and P. When you are turning to the right, these steps will climb to the right. When you are turning to the left, the steps will climb to the left.

P: This shows your degree of Pitch. When P is 0, your aircraft's nose is level. When P is a positive number (other than 0) your nose is up. The larger the number, the higher the nose is pointed. A negative P means your nose is pointed down. When you are flying level, a bar (the Horizon Indicator) goes midway up the space to the left of P. When your nose is pointed down, the bar will go to the top of this space. When your nose is pointed up, the bar will be a thin line along the bottom. A P of 1 is a 5-degree pitch. A P of 9 is a 45-degree pitch. *NOTE: Under certain conditions, it is possible to lose altitude when your nose is pointed up (P is a positive number >0).*

1-4: There are four engines. These are represented by the four numbers above the four boxes. The numbers show how

×4. While playing the game, pressing **N** will call on the navigator to display the X and Y coordinates of the aircraft (if known) and the time that has elapsed since the beginning of the mission. A miniature version of the strategic map will appear on the screen. On this map, the location of your aircraft (if known) will appear as a white plus symbol (or diamond). The locations of landing strips and bomb targets will be shown as white rectangles. The location of fighter rendezvous areas will be shown as black Xs. Pressing **E** will call on the engineer to display the amount of fuel remaining and the number of bombers formed up.

The game will pause while you are receiving this information and start again when you press the space bar. Other important information will be displayed here throughout the mission. Remember these messages.

16. Miscellaneous

Clouds

Clouds drift across the screen and can totally obscure your view of the ground at any time. When this occurs, your navigational instruments will be unable to provide you with X Y information. Total cloud cover can occur even in areas designated as having clear weather.

Clouds can be dealt with by waiting for them to go away, by counting blocks and using the map to determine location, or by reckoning the location of targets or airstrips based on experience or referencing the Data Card.

Landing

All landings in the game have to be made at the southern ends of the airstrips. You should approach all airstrips from the south.

Bailing Out

You may bail out anytime you are over land and at least 500 feet above the land altitude. If you bail out over friendly territory, you will save your crew. If you bail out over enemy territory, your crew may be lost or captured.

There is a chance that your crew will be rescued by friendly partisans and eventually returned to you. The closer you are to Italy when you bail out, the greater the chance your crew will be rescued.

Recovering From a Spin

For a variety of reasons, you may find yourself in a spin. When VSI reads XXX, you are losing altitude at more than 1000 feet a minute. To recover from this, first level out your airplane (set B and P to 0 and make sure the Horizon Indicator shows you are flying level). After you have leveled out, power up and dive. When your IAS begins to go up instead of down, set pitch to 0 and wait for a 0 VSI indication.

Aborting a Mission

Missions may be aborted before or after takeoff by pressing the **22** key (shift/**fl**). If a mission is aborted, it does count as one of your campaign missions.

When a campaign mission is aborted, your plane will drop its bombs. You should then return to the air base. Your group will complete the mission without you. The bombing accuracy of your

air speed versus power setting is affected by drag of flaps, open bomb bay doors, landing gear, windmilling engines, pitch of the nose, and rate of turn.

The following are a few hints to help get the most out of the game:

1. Be sure to speed up time whenever practical, especially over long straight stretches. (Most turns can easily be done at ×4 speed except for small heading changes.) Long, straight climbs out are best done at ×60.

2. Wind down the runway shortens takeoff roll. Taking off with heavy loads is easier on windy days.

3. Max load take off is best done by pitching up 1 when you get just above stall speed and then immediately pitching back to 0. Quickly get the gear up and when the airspeed climbs to 140, bring the flaps up to 10 degrees. Then when the airspeed gets above 150, raise the flaps to 0 degrees and start your climb.

4. If an engine quits on take off, abort.

5. If you lose your IAS and VSI instruments due to damage, don't panic. You can still watch your altitude and time changes to get vertical speed. The stall warning will tell you when you are

5 mph above stall speed. Experience will help you to estimate your airspeed with altitude, load, and power setting.

6. If you lose navigation (XY readings), count blocks as they go by. Each block is ten miles square.

7. Plan each bomb run before you go there. Try to find the shortest route over the target flak. Set an Initial Point 20 miles before the target, track in to the target, drop your bombs, and close the bomb bay doors quickly, to avoid a loss in airspeed and wasting fuel.

8. You can always use Vis as an emergency field. Don't forget Foggia as it is closer to home and you can get there without going above 2000 feet.



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